UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,976	07/10/2003	Toru Futami	240108US3	3393

22850 7590 06/11/2009

OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
LEUNG, JENNIFER A	

ART UNIT	PAPER NUMBER
1797	

NOTIFICATION DATE	DELIVERY MODE
06/11/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary	Application No.	Applicant(s)	
	10/615,976	FUTAMI ET AL.	
	Examiner	Art Unit	
	JENNIFER A. LEUNG	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 February 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,8,10-18,20-24 and 35-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,8,10-18,20-24 and 35-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on February 19, 2009 has been carefully considered. Claims 6, 7, 9, 19 and 25-34 are cancelled. Claims 35-41 are new. Claims 1-5, 8, 10-18, 20-24 and 35-41 are under consideration.

Specification

2. It is noted that the application file contains two versions of the abstract: i) a new abstract filed December 5, 2006, which replaced the original abstract; and ii) an amended abstract filed April 28, 2008, which is an amended version of the original abstract. It is unclear as to which abstract is the correct abstract.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-5, 8, 10-18, 20-24 and 35-41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1 and 24, it is unclear as to whether Applicant is attempting to claim the "fluid containing a catalyst" as an element of the apparatus, because the fluid containing a catalyst does not appear to be positively recited in the claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 3, 4, 8, 12-14, 17, 18, 20-24, 37 and 39-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harston et al. (WO 99/22858) in view of Christel et al. (US 6,368,871) and Turner et al. (US 6,306,658).

Regarding claims 1, 3, 4 and 24, Harston et al. (FIG. 1; page 6, lines 5-18) discloses an apparatus comprising: a fine channel (i.e., reactor channel **3**; page 2, lines 14-22) provided with first and second inlet ports configured to feed fluid; first and second inlet channels (i.e., input channels **5** and **1**, respectively) communicated with the first and second inlet ports, respectively, wherein a fluid containing a catalyst (e.g., an aqueous phase containing a mixture of nitric acid and sulphuric acid catalyst; see page 6, lines 10-11; also, page 1, lines 7-10) flows from the first inlet port to the first inlet channel **5**; a confluent portion (i.e., where the channels **5** and **1** join) communicated with the first and second inlet channels; a branch portion (i.e., at the end of the reaction channel **3**) from which first and second outlet channels (i.e., output channels **11** and **9**, respectively) are branched and configured to feed predetermined amounts of fluid; and first and second outlet ports communicated with the first and second outlet channels **11**, **9** respectively.

(See also similar configuration in FIG. 2, wherein inlet and outlet ports **13**, **15**, **25** and **29** are further labeled; page 6, lines 19-25).

Harston et al. fails to disclose a circulating channel, configured to feed the fluid containing catalyst discharged from the first outlet port (i.e., from output channel **11**) to the first inlet port (i.e., to input channel **5**). Harston et al., however, discloses that in a nitration reaction for instance, it is conventionally known to recycle the aqueous phase (which contains the nitric acid and sulphuric acid catalyst) after product separation (see page 1, lines 10-12). Turner et al. further evidences that the provision of a circulating channel, for enabling fluid recycle, would have been well known in the art of fluid distribution (see FIG. 7; column 11, lines 33-58). Accordingly, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a circulating channel in the apparatus of Harston et al., to enable the recycle of the aqueous phase after product separation.

Harston et al. is further silent as to the apparatus comprising the claimed plurality of partition walls along a boundary (i.e., interface **7**) formed by the aqueous and organic fluids.

Christel et al. teaches an apparatus (FIGs. 3-5, 1f, 1g; column 2, line 56 to column 3, line 10) comprising: a fine channel (i.e., contact or interdiffusion region **110**) provided with at least two inlet ports; inlet channels (i.e., deep channels **101** and **102**) communicating with the inlet ports; a confluent portion (i.e., the point of intersection of channels **101** and **102**) communicating with the inlet channels; a branch portion (i.e., at the point where channel **110** splits into channels **103** and **104**) communicating with the fine channel **110**, from which at least two outlet channels **103** and **104** are branched; and outlet ports communicating with the outlet channels **103** and **104**. In particular, the fine channel is provided with a plurality of partition walls (i.e., micro-columns

111; see also column 7, lines 40-54) arranged along a boundary formed by at least two kinds of fluid fed from the inlet ports; wherein the plurality of partition walls **111** are arranged with intervals in a flowing direction of fluid (see FIGs. 5, 1f and 1g); wherein, as best shown in FIG. 1f, the height of the partition walls **111** is substantially the same as the depth of the fine channel **110** (see also column 7, lines 40-54); and wherein each of the partition walls **111** has an upper edge that is elongated and extends along a line parallel to a fluid flow path within the fine channel (see, e.g., FIG. 1f, 1g, 5). In the embodiments of FIGs. 1h and 2, Christel et al. further teaches the provision of a partition wall at the intersecting portion between two channels, wherein the partition wall defines a continuous partition wall, positioned in the vicinity of and connected to the intersecting portion of two channels. Also, the partition walls **111** may be provided at positions apart from the confluent portion and the branch portion (see FIG. 5).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the claimed configuration of partition walls in the apparatus of Harston et al., including partition walls disposed at intervals within the fine channel and the continuous partition walls at the confluent and branch portions, because the partition walls would help maintain stability of the fluid streams, as taught by Christel et al. (see, e.g., column 6, line 58 to column 7, line 9).

The limitation of the intervals being, "a distance that is greater than an elongated length of each partition wall," is not considered to confer patentability to the claim since the precise distance would have been considered a result effective variable by one having ordinary skill in the art. For instance, Christel et al. (column 6, lines 58-68) teaches that,

> "... depending on the stability of the fluid streams in contact with each other, it may be possible to have a very long diffusion region, with no equilibration regions. In this case,

> the fluid flow could be "flat" on the surface of the element. On the other hand, if the stability of the fluid streams is very low, it is possible to provide additional very small "pillars" along the diffusion interface (like miniature jail bars) to further reduce the tendency of the fluids to mix or the streams to become unstable."

Accordingly, one having ordinary skill in the art would have routinely optimized the distance between the partition walls for a given partition wall length in the modified apparatus of Harston et al., in order to maximize the rate of diffusive transfer of a constituent from one fluid stream to the other fluid stream through the interfacial boundary, while maintaining a stable interfacial boundary between the two or more fluid streams and reducing the tendency of the fluids to mix and become unstable, and where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Regarding claim 8, Harston et al. is silent as to a portion of the fine channel having a shape other than a straight shape, wherein said portion includes a wall disposed along the boundary that extends from the vicinity of a portion originating a non-straight portion of the fine channel to the vicinity of a portion ending the non-straight portion of the fine channel. Christel et al., however, teaches a portion of fine channel having a shape other than a straight shape (i.e., a zigzagging shape; see lower device in Figure 1g), wherein said portion includes a wall disposed along the boundary that extends from the vicinity of a portion originating a non-straight portion of the fine channel to the vicinity of a portion ending the non-straight portion of the fine channel. It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure a portion of the fine channel in the modified apparatus of Harston et al. to have a shape other than a straight shape and to include a wall as claimed, because such a configuration would have allowed for the formation of a long fine channel length on a small area of substrate,

as evidenced by Christel et al.

Regarding claim 12, the modified apparatus of Harston et al. meets the claim, since the direction of flow of a first fluid relative to a second fluid is considered intended use.

Regarding claims 13 and 14, Harston et al. fails to disclose that the inner wall at one side of the fine channel has at least one of hydrophilic or hydrophobic properties. Christel et al., however, teaches that the hydrophobicity/hydrophilicity of the inside surfaces may be customized to impart further stability to the fluid streams and prevent physical mixing (column 7, lines 1-9; also, column 6, lines 14-20). It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the inner wall at one side of the fine channel in the modified apparatus of Harston et al. to have at least one of hydrophilic or hydrophobic properties, because such would help increase the stability of the fluid stream and prevent physical mixing, as taught by Christel et al.

Regarding claims 17 and 18, Harston et al. fails to disclose a metallic film and a current or voltage supply means for the metallic film. Christel et al. teaches the provision of a current or voltage supply means (i.e., AC or DC; column 8, line 14 to column 9, line 15) for an underlying conductor disposed in the entire or a part of the inner surface of the fine channel and/or the wall surface of the partition walls. The Examiner takes Official Notice that the use of metallic films as electrically conductive materials is well known in the art. It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a metallic film and a current or voltage supply means in the modified apparatus of Harston et al., because such would allow for the materials to be manipulated according to charge, as taught by Christel et al.

Regarding claim 20, Turner et al. (see FIG. 7; column 11, lines 33-58) further teaches

that the circulating channel for delivering a fluid **290** from a discharge port **302** to an input port **298** of a thermal fluid passageway **300** includes a reservoir tank **292** and a pump **294**.

Regarding claims 21, 22 and 37, Harston et al. discloses that the reaction occurs under elevated temperature (see page 4, lines 8-10), but does not specifically disclose a heating device. Christel et al. teaches that it is known to provide a heating device (column 9, lines 29-37), to supply heat to a fluid flowing through a fine channel. The heating device **18** (FIG. 6) covers the length of the fine channel, and hence, covers an upstream side of the fine channel. It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the heating device as taught by Christel et al. in the modified apparatus of Harston et al., to provide a known means for maintaining the fine channel at the necessary elevated reaction temperature.

Regarding claim 23, Harston et al. discloses that the apparatus may comprise a plurality of fine channels formed two- or three-dimensionally (see page 7, lines 14-18; page 8, lines 3-8).

Regarding claims 39-41, as best understood, the catalyst (i.e., sulphuric acid) comprises a temperature dependent phase transfer catalyst, since the reaction is carried out at elevated temperature (see page 4, lines 8-10). Alternatively, it appears that the modified apparatus of Harston et al. meets the claim, since the fluid containing catalyst is not positively recited as an element of the apparatus.

5. Claims 2, 5, 10, 11, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harston et al. (WO 99/22858) in view of Christel et al. (US 6,368,871) and Turner et al. (US 6,306,658), as applied to claim 1 above, and further in view of Young et al. (US 2003/0226806).

Regarding claims 2 and 5, Young et al. (sections [0041]-[0042]) teaches that the diffusive

transfer of a constituent through the interfacial boundary can be controlled by simply varying the dimensions, shape and/or grouping/spacing of the partition walls **200** within the fine channel **10**. Thus, it would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the intervals between adjacent partition walls, in the vicinity of the inlet or outlet channels, to be smaller than the intervals between adjacent partition walls in a central portion of the fine channel, in the modified apparatus of Harston et al., as appropriate for controlling the diffusive transfer along the fine channel for a given fluid system.

Regarding claim 11, Harston et al. is further silent as to the claimed plurality of projections being formed at an inner wall of the fine channel. Young et al., however, teaches a plurality of projections (i.e., channel structures **400**; FIG. 12; [0048]) being formed at an inner wall of the fine channel. It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the claimed plurality of projections at the inner wall of the fine channel in the modified apparatus of Harston et al., because the projections would promote an even distribution of constituents within a fluid stream, as taught by Young et al.

Regarding claims 10, 15 and 16, the combination of Harston et al., Christel et al. and Turner et al. fails to suggest the claimed film being disposed between adjacent partition walls in a flowing direction of fluid. Young et al., however, teaches a film (i.e., a polymer membrane **300**; FIG. 11 and section [0047]) disposed between adjacent partition walls in a flowing direction of fluid, said film having fine pores of a diameter smaller than any distance **205** between adjacent partition walls **200** is provided between adjacent partition walls **200** in a flowing direction of fluid. In the vicinity of the inlet channels **100** and/or the outlet channels **100**, at least two partition walls **200** are connected continuously (i.e., via a membrane **300**) in a flowing

direction of fluid (see FIGs. 4,11). It would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the claimed film between the adjacent partition walls in the modified apparatus of Harston et al., because the film would help maintain the boundary between the fluids, while still allowing for diffusive transfer, as taught by Young et al.

Allowable Subject Matter

6. Claims 35, 36 and 38 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

The prior art does not disclose or adequately suggest the claimed fine channel device, wherein the device further comprises a means for supplying energy to the fluid flowing in the fine channel, said means comprising a light irradiation device. In addition, the prior art does not disclose or adequately suggest the claimed fine channel device, wherein the device further comprises a means for supplying energy to the fluid flowing in the fine channel, said means comprising a heating device disposed at an upstream side of the fine channel; and a heat insulation material embedded in the fine channel device at a downstream side of the fine channel.

Response to Arguments

7. Applicant's arguments have been considered, but they are now moot in view of the new ground(s) of rejection, as necessitated by amendment.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter D. Griffin can be reached on (571) 272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/
Primary Examiner, Art Unit 1797